Mining

PROJECT DATA

David Bell - 02GO12047

Non-Invasive Estimation of Dissolved Alumina Concentration in Hall-Héroult Reduction Cells

Recipient:	David Bell	Instrument Number:	DE-FG36-02GO12047
Recipient Project Director:	David Bell 509.466.2656 409 East Shore Road Nine Mile Falls, Washington 99026	CPS Number:	1822
		HQ Program Manager:	Lisa Barnett 202.586.2212
		GO Project Officer:	Glenn Doyle 303.275.4706
Recipient Type:	Individual	GO Contract Specialist:	Melissa Wise 303.275.4907
Subcontractor(s):		B&R Number(s):	ED190602
		PES Number(s):	02-2214
EERE Program:	Industrial Technologies	State Congressional District	WA - 5

PROJECT SCOPE: The objective of this project is to develop a method to identify the dissolved alumina concentration in the Hall-Héroult reduction cell, using estimated properties of the cell resistance disturbance caused by the introduction of suspended alumina particles comprising the normal feed to the cell. The project will optimize this electrochemical process using digital signal processing technology to assure the process will operate at maximum efficiency. An industry-wide energy improvement of 2% current efficiency is expected. There are no new wastes associated with this technique.

FINANCIAL ASSISTANCE

Approved DOE Budget	$29,200	Approved DOE Share	$29,200
Obligated DOE Funds	$29,200	Cost Share	$0
Remaining Obligation	$0		
Unpaid Balance	$14,000	**TOTAL PROJECT**	**$29,200**

Project Period: 8/01/02 to 09/01/03

TECHNICAL PERFORMANCE

DE-FG36-02GO12047

David Bell

Non-Invasive Estimation of Dissolved Alumina Concentration in Hall-Héroult Reduction Cells

PROJECT SYNOPSIS

The goal of the proposed project is to develop a method to identify the dissolved alumina concentration in the Hall-Héroult reduction cell, using the estimated properties of the cell resistance disturbance caused by the introduction of suspended alumina particles comprising the normal feed to the cell. Extraction of primary aluminum from its mineral form is achieved by reduction in an electrochemical cell. The project seeks to optimize this electrochemical process using digital signal processing technology, to assure the process will operate at maximum efficiency. The techniques to be developed within the scope of this proposal are expected to apply with similar efficacy to 'conventional' pre-bake anode reduction cells, to the wetted cathode cells presently in development, and to inert anode cells being developed. An industry-wide energy improvement of 2% current efficiency is expected. There are no new wastes associated with the proposed technique.

SUMMARY OF TECHNICAL PROGRESS

This is a FY2002 award and the project commenced 08/20/02.

The creation of the feed pulse computational model and procurement of project computer/MatLab® software is complete.

SUMMARY OF PLANNED WORK

This project is complete and Final Report has been received.

PROJECT ANALYSIS

The development of a method to identify the dissolved alumina concentration in the Hall-Héroult reduction cell was not successful. Additional testing is required per Mr. Bell, and he indicates a three to five year effort would help to understand the commercial market.

ACTION REQUIRED BY DOE HEADQUARTERS

No action is required from DOE Headquarters at this time.

STATEMENT OF WORK
DE-FG36-02GO12047
David Bell
Non-Invasive Estimation of Dissolved Alumina Concentration in Hall-Héroult Reduction Cells

Detailed Task Description

Task 1. Create feed pulse computational model

Task one is to apply well-developed electrochemical models for the Hall-Héroult reduction process to create a mathematical description for the feed pulse which incorporates the alumina concentration in a computationally practical way.

Task 2. Procure computer and MatLab®

Task 2 involves the Specification and purchase of suitable workstation-type computer and operating system and MatLab® numerical analysis software tools.

Task 3. Determine signal identification requirements

Signal identification requirements will be determined through numeric analysis of characteristics and sensitivities of the feed pulse model created in Task 1.

Task 4. Synthesize 'noisy' reduction cell signals

Synthetic reduction cell signals suitable for analysis in Task 5 will be created, including the effects of known disturbances in reduction cells as well as heavy-tailed stochastic signals.

Task 5. Analyze possible identification algorithms

Higher-order statistical signal processing methods will be applied to propose and analyze computational algorithms suitable for the identification of the dissolved alumina concentration in real time

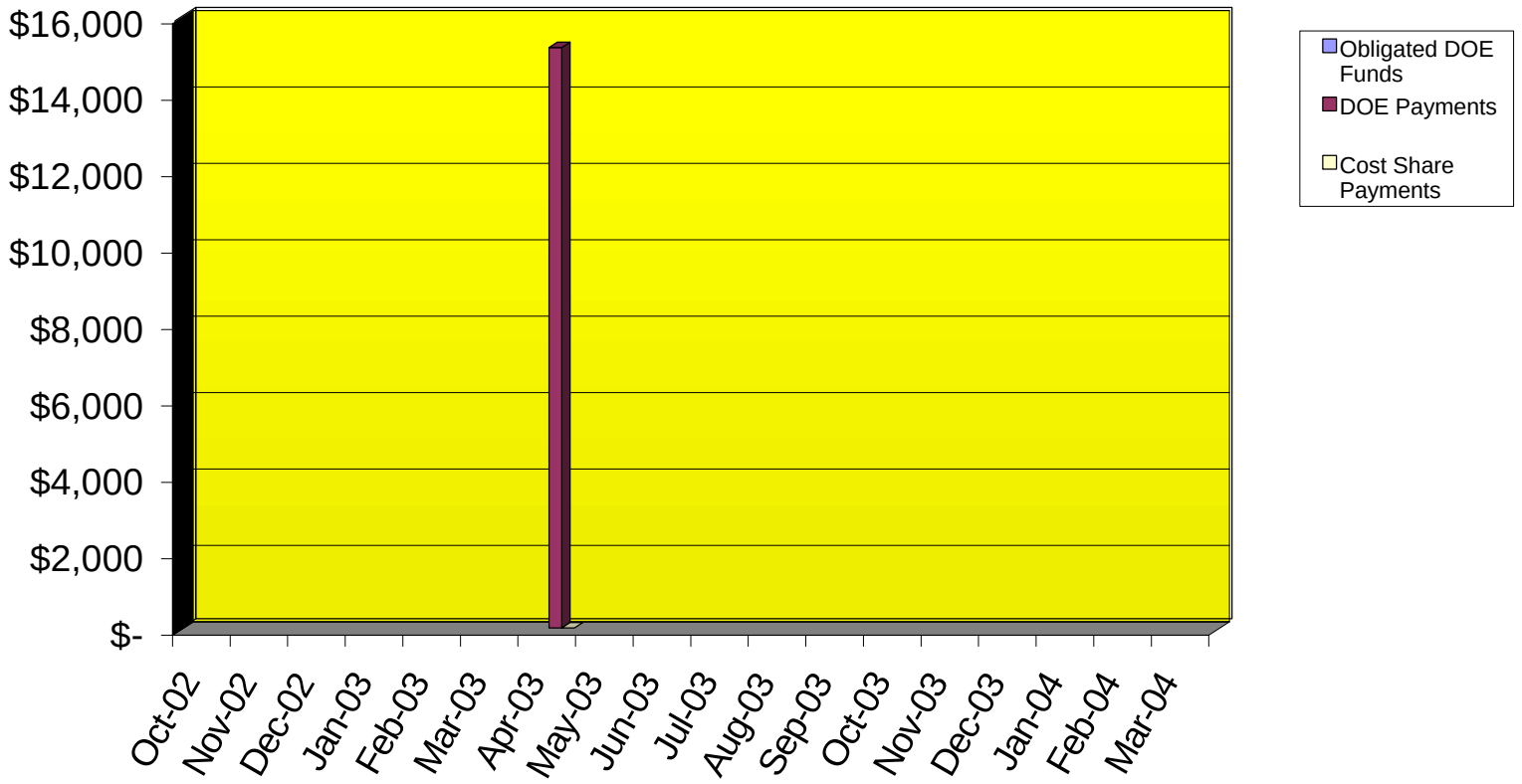
Task 6. Evaluate Digital System Processor (DSP) suitability

DSP device performance requirements for the proposed algorithm will be estimated. Key considerations for implementation of the proposed techniques in a reduction cell control system utilizing low cost embedded DSPs will be indentified.

Project Cost Performance in DOE Dollars for Fiscal Year 2003

DE-FG36-02GO12047 **David Bell**

Non-Invasive Estimation of Dissolved Alumina Concentration in Hall-Heroult Reduction Cells



	Oct-02	Nov-02	Dec-02	Jan-03	Feb-03	Mar-03	Apr-03	May-03	Jun-03	Jul-03	Aug-03	Sep-03
Obligated DOE Funds	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
DOE Payment	$0	$0	$0	$0	$0	$0	$15,200	$0	$0	$0	$0	$0
Cost Share Payment	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0

	Oct-03	Nov-03	Dec-03	Jan-04	Feb-04	Mar-04	PFY*	Cumulative
Obligated DOE Funds	$0	$0	$0	$0	$0	$0	$29,200	$29,200
DOE Payment	$0	$0	$0	$0	$0	$0	$0	$15,200
Cost Share Payment	$0	$0	$0	$0	$0	$0	$0	$0

Approved DOE Budget:	$29,200
Approved Cost Share Budget:	$0
Total Project Budget:	$29,200

* Prior Fiscal Years

Mr. David Bell - 02GO12047

ID	Task Name	Start	Finish
1	Create feed pulse computational model	Mon 9/2/02	Mon 12/2/02
2	Procure computer and MatLab	Mon 9/2/02	Mon 12/16/02
3	Determine signal identification requirements	Mon 9/2/02	Mon 3/3/03
4	Synthesize 'noisy' reduction cell signals	Mon 9/2/02	Thu 3/20/03
5	Analyze possible identification algorithms	Mon 9/2/02	Tue 6/3/03
6	Evaluate DSP suitability	Mon 9/2/02	Tue 7/15/03
7	Prepare & submit final report	Mon 9/2/02	Mon 9/1/03